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Conditions for Successful Strategic Alliances in the Food Industry

ABSTRACT: This paper focuses on strategic fuzzy alliances (SFAs) and the role of trust in business-to-business relationships. First, a theoretical model of governance choice involving strategic alliances is developed, integrating the Shapiro, Sheppard, and Cheraskin (1992) taxonomy of trust into a neoinstitutional framework. Second, this model, based on transaction theory, is then used to generate necessary and sufficient conditions for trust-based agreements. The third component of this paper is an empirical model, which tests the above theory. Finally, managerial implications from the results are discussed.

Many changes in the global economy have increased the efficiency and speed with which firms gather information and compete on a world scale. As a result of these changes, foreign competition is increasing, product life cycles are shortening, and markets are becoming more specialized. Traditional barriers for the firm such as duties, tariffs and nontariff barriers are being broken down or eliminated by trade agreements such as GATT and NAFTA (Amanor-Boadu and Martin, 1992; Cohn, 1993). These global and regional agreements have affected trade patterns and, by favoring specialization, the location of production (West and Vaughan, 1995).

One critical element of firm survival is the governance structure of the firm. The hierarchical structure of a company and the degree to which a company

internalizes decisions affects the company's efficiency, both internally and externally. In such a fast-paced environment low operating costs are a key to financial success, and quick, accurate decision making is paramount. The need to respond to a situation quickly and easily, but also cost effectively, has induced managers to look outside their own companies to other firms for cooperative agreements.

This paper focuses on the formation of new business arrangements, such as strategic fuzzy alliances (SFAs), which are unique because they involve trust. The aim of this paper is to analyze these alliances and the role of trust in business-to-business relationships. First, a theoretical model of governance choice involving strategic alliances is developed, integrating the Shapiro et al. (1992) taxonomy of trust into a neoinstitutional framework. Second, our model, based on transaction theory, is then used to generate necessary and sufficient conditions for trust-based agreements. The third component of this paper is an empirical model, which tests the above theory. The model uses a recent survey, conducted by Dionne, Lambert, Romaine, and Coffin (1996), of horticultural and pork processing firms and a multinomial logit technique in order to explain the governance choice decision. Finally, managerial implications are discussed focusing on relationship building and relationship management.

THEORETICAL MODEL

Background

In 1937, Coase (in Williamson, 1991) theorized that by internalizing transactions, governance costs could be reduced at times while, at other times, the market has a valuable role to play in a firm's ability to compete. In the 1970s Williamson used Coase's theories as the basis for transaction cost economics, adding to them human elements such as opportunism and bounded rationality (Williamson, 1985; Simon, 1957). From this, a continuum of governance choice has become the foundation of transaction economics (see Figure 1).

There are three sections to the continuum of governance: from left to right they are the spot market; quasi-integrated alliances; and vertically integrated firms. At the spot market there are many buyers and sellers, transactions are governed by price signals (Sporleder, 1992), and property and ownership are fully defined; thus a contract is not necessary. In the area of vertical integration there is 100% ownership. All business units have a similar overriding objective and a common culture. A commonality exists here that may not be found in other areas of the continuum and, as a result, a contract is not necessary. Quasi-integrated firms, in the center of the continuum, govern transactions through contracts. Here bilateral trading partners avoid the costs of arranging each and every transaction in the spot market while still not fully internalizing the transaction either.

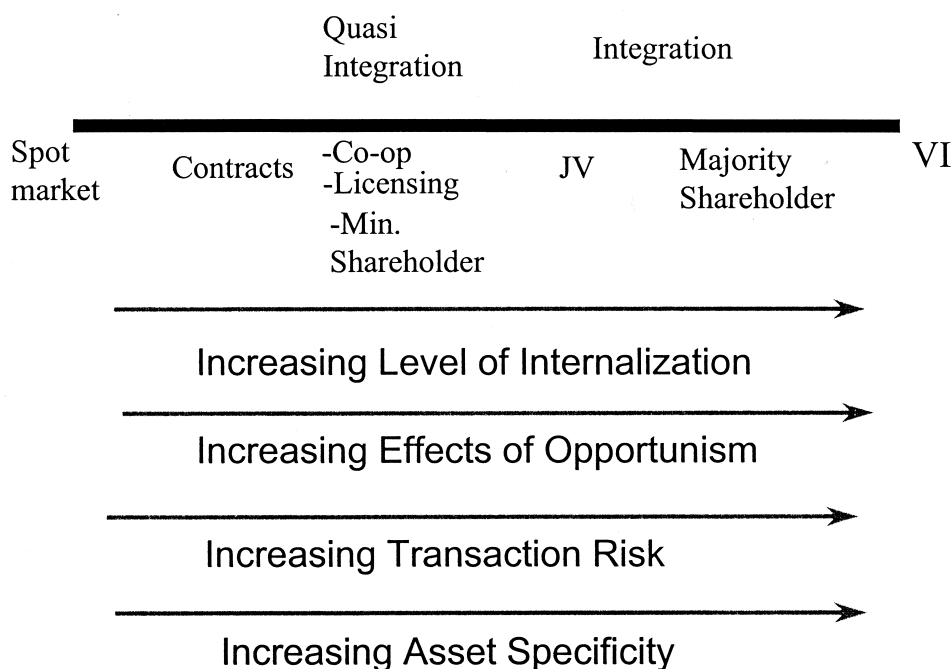


Figure 1. Continuum of Governance with Transaction Cost Economic Attributes

Moving from left to right along the continuum of governance, transactions are internalized and external costs to the firm decrease. On the other hand, the intricacy of the transaction increases, the assets involved in an agreement become more specialized to that agreement (increasing asset specificity), and governance structures become more complex (Ring and Van de Ven, 1992). The elements contributing to bounded rationality and opportunism increase, making the transaction environment more risky. Bounded rationality and opportunism, the cornerstones of transaction costs, are major causative forces for contracting under conditions of moderate levels of specificity and internalizing at higher levels of specificity. Not only do individuals search for governance structures that reduce direct costs, but also methods for protecting against opportunistic behavior from their bilateral trading partners. Thus trust has a direct role in cost reduction because, in the limit, with complete trust there is no opportunism (Chiles and McMackin, 1996).



The theoretical and empirical question which is the focus of this research is : where do trust-based alliances, such as strategic fuzzy alliances, fall on the governance choice continuum? Although much has been written about opportunism, neoinstitutional economics is devoid of work addressing trust-based governance structures such as SFAs.

Strategic Fuzzy Alliances

While neo-classical economics is founded on the notion of competition and opportunism, which is the basis of behavior for economic man, fuzzy alliances involve co-operation, loosely specified prerogatives, and a trusting environment (Sporleder, 1993). The boundaries of neo-classical firms are strictly defined and distinct, whereas fuzzy alliances are highly flexible and their boundaries much less clear (Sporleder, 1993). In a fuzzy alliance there is shared control. The system is an open structure where knowledge flows easily between the two firms, as through a “membrane” connecting two living organisms (Hamel, 1991). Success is based on co-operation, using each other’s wisdom and ideas to advance both firms into the future. Innovation, learning and communication are encouraged, to allow firms to keep pace in a rapidly changing environment, innovation, learning and communication are encouraged (Vyas, Shelburn, and Rogers, 1995). In the event of mistakes or misjudgements exit costs are low allowing firms to break relations quickly and easily (Sporleder, 1992). Each partner is a stakeholder but not necessarily a shareholder in the operation (Sporleder, 1993). A key feature of the non-contract-based alliance is trust. Maintaining trust in the relationship allows for a level of flexibility and rapid change, not attainable in traditional business alliances.

Being able to maintain trust in a business relationship can be highly advantageous to all parties involved. Through trust there is: 1) a decrease in transaction costs, 2) an increase in flexibility for both companies, 3) an increase in knowledge and 4) a decrease in risk (Maitland, Bryson, and Van de Ven, 1985; Shapiro et al., 1992; Dodgson, 1993; and Parkhe, 1993). Interestingly, it was even shown by Axelrod (Hill, 1990, p. 507) “. . . that over time actors whose decision rules stressed co-operation and trust, rather than opportunism, came to dominate the population of players.” Without trust a fuzzy alliance cannot exist; therefore to understand strategic fuzzy alliances completely it is necessary to analyze and discuss the key component of these agreements, trust.

Trust: necessary and sufficient conditions. SFAs fall under a broader category of new¹ governance structures, strategic alliances (SAs). Alternatively, those alliances that primarily rely on binding mechanisms other than trust may, for simplicity, be described as contract-based and for the purposes of this paper be identified as strategic contract alliances (SCA) (see Figure 2). On the continuum of governance choice, strategic contract alliances reside between spot markets and vertical integration in the area of hybrid structures. They represent the broad class of SA involving more formal coordination and which have been described as joint ventures, equity partnerships, development agreements, supply agreements, manufacturing collaboration and marketing agreements (Nohria, 1991). While the taxonomy of strategic alliances is not the focus of this paper,² it is enough to say though that SCAs encompass many types of strategic bilateral trading arrange-

	SUFFICIENT CONDITIONS
	NECESSARY CONDITIONS
SA	STRATEGIC ALLIANCE
SCA	STRATEGIC CONTRACT ALLIANCE
SFA	STRATEGIC FUZZY ALLIANCE
C-	COGNITIVE THOUGHT
E-	EMOTIONAL THOUGHT

PRIMARY BUILDING BLOCKS	SECONDARY BUILDING BLOCKS
R - RISK	CO - COOPERATIVE BEHAVIOR
F - FREE WILL	FAM - FAMILIARITY
K- KNOWLEDGE	REP - REPUTATION
P - PREDICTABILITY	

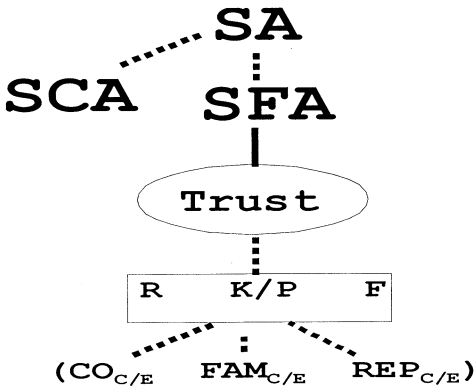


Figure 2. Strategic Alliances and Trust

ments. The governance choice may be quite traditional, i.e., license, contract, or joint venture, but the choice of partners or the objectives of the alliance are nontraditional. SFAs on the other hand utilize trust as a governance mechanism, substituting it for a contract as the transaction's binding force.

Trust is a *necessary* condition in the formation of an SFA and is defined as "...the expectation by one person, group or firm of ethically justifiable

behavior . . . on the part of the other person, group, or firm in a joint endeavor or economic exchange” (Hosmer, 1995). Two elements of the human psyche are utilized when an individual makes a decision to trust: cognitive (C) and emotional (E) thought (Lewis and Weigert, 1985) (see Figure 2). The cognitive component refers to the ability of an individual to rationally determine whether or not someone is worth the risk of being trusted. The emotional feature is related to sensory responses elicited by all humans in acknowledgment of preferences or feelings for people or things.

Within the context of cognitive and emotional decision making, the elements that are believed to engender trust are: *knowledge*, *risk*, *free will* and *predictability* (Lewis and Weigert, 1985; Dodgson, 1993; Dasgupta, 1988; Luhmann, 1988; Gambetta, 1988). Independently, these elements do not create trust, however, when joined together in specific combinations they are sufficient for its formation.

Knowledge

Knowledge can be gained from previous experiences, research, reputation or conversation. It allows one to determine from the past what the future might hold, and in this way permits us to predict future outcomes. Knowledge itself does not cause trust, but it is an important ingredient (Lewis and Weigert, 1985). In the event of perfect knowledge, complete rationality, trust is not necessary (Gambetta, 1988) and in the event of no knowledge, a gamble has taken place and trust has not been formed (Lewis and Weigert, 1985).

Predictability

This is the ability to rely on the actions of others based on prior knowledge. One must have enough knowledge of an individual or firm to allow for inference as to possible future actions based on past events or information, i.e., it must be possible to predict an outcome *a priori*. At low levels of knowledge, prediction is a cognitive action and a function of information quality. At higher levels of knowledge, i.e., identification (Shapiro et al., 1992), predictability is not so much cognitive as an emotive action.

Free will

Free will refers to the ability of an individual to make a choice of whether or not to trust another individual, group or firm. By using a combination of cognitive and emotional elements this decision is made either consciously (through logical decision making) or unconsciously. For example, if an individual is given two choices: 1) that his/her company may decrease research and development costs by forming a trust-based alliance with another firm, or 2) that the company might fall behind if it goes it alone, the firm has an opportunity to choose a course of action (free will). On the other hand, if the firm or individual is in a position of duress

and economic death will result in a decision to not trust, then a choice does not really exist and trust is not apparent in the relationship (Nooteboom, 1996). Thus free will is fundamental to trust formation.

Risk

The final element, and the most crucial to the formation of trust, is risk. A person places themselves in a situation of risk when they enter into a relationship where perfect information is not available, future events are uncertain or there is a possibility of injury and/or loss (Ring and Van de Ven, 1992; Chiles, 1996; Lewis and Weigert, 1985). In order for trust to occur, risk must exist (Luhmann, 1988). Without risk, trust is not necessary as all information is present and the future can be determined with certainty or, if it can't be determined with certainty, the unexpected event is as good as the expected event, therefore riskless.

If someone plays the lottery and knows with certainty the number of other tickets in the lottery, the probability of their ticket being selected can be calculated. Trust is not necessary because one knows with certainty the event will take place and thus there is a fixed chance of winning. However, if someone enters a lottery and the number of tickets sold is unknown then the future possibility of winning is not possible to calculate. One must trust that it is a fair game but because not all information is available and future events are unpredictable, the expectation of winning has been decreased. Thus the element of risk is an important component for the formation of trust.

All four elements, knowledge, predictability, free will, and risk, do not have to be present for trust. In specific combinations they are sufficient for trust and form the backdrop to the empirical tests developed further along in this paper. With respect to the question of SFAs these elements together constitute the sufficient conditions to form trust.

Free will is captured in the empirical model because governance choice decisions are being modeled. Consistent with neoinstitutional theory, the firm/agent is making a cost minimizing decision where the choice of governance structure is made (Goldsmith and Sporleder, 1998). *Risk* too is evident in the decision process. *Ceteris paribus*, transaction risk increases along the continuum due to increasing asset specificity (Nooteboom, 1993; Goldsmith and Sporleder, 1998).

The final element for trust to form is some form of *knowledge*. Knowledge can come in a variety of forms. It may arise through cooperation, familiarity, or reputation (see Figure 2).

Cooperation is defined as the act of working with another group or firm to achieve a common goal. It takes place before trust is established and through repeated actions of cooperation, trust will be created (Gambetta, 1988). Thus cooperation is a sufficient condition for acquiring knowledge and trust-based

relationships should be positively correlated to firms which have a history of working together (Ring and Van De Ven, 1992; Gulati, 1995).

Knowledge can also arise through familiarity; that is, having a common heritage, experiences, or culture. Geography (same region), organizational form (cooperative), language, and heritage (entrepreneurial start-up) all may enhance the formation of trust.

A final condition sufficient for the knowledge necessary to produce a trust-based relationship is reputation. You might not have to have direct knowledge of the firm you are going to ally yourself with; indirect information may suffice. Reputation is a proxy for knowledge (Parke, 1993). Firms that are more established with longer track records may be more likely to be involved in SFAs. However, when reputation takes on the role serving as a hostage asset, it is a substitute for trust. We trust the other person not because we know of their good work or some common identity that binds us together but because if they renege we expose their behavior, tarnishing their reputation.

Each of the three primary building blocks of trust is integral to the formation of a distinct type of trust. Changing levels of cognitive and emotional decision-making processes helps to categorize different trusting relationships. Also each element within a building block may differ in intensity which gives rise to different types of trust.

Taxonomy of Trust

Trust is not a static concept. Shapiro et al. (1992) describe three main categories of trust: 1) deterrence; 2) knowledge; and 3) identification-based trust (see Figure 3). The authors state that "...each previous basis of trust is a necessary condition for the one that follows."

Deterrence-based Trust

Deterrence-based trust is necessary when the relationship is based on little or no knowledge. It is the lowest form of trust. This type of governance relies on the fact that the cost (in absolute value) to each agent of defaulting on the relationship is greater than the benefits of continuing in the relationship. Deterrence-based trust is consistent with the calculus of "economic man" and a Smithian idiosyncratic optimizer. It is based on cognitive action, freewill and rational economic behavior. Agents may exit freely depending on their assessment of the costs to leave versus the benefits of remaining. This type of governance structure is the most fragile. There is such a low level of investment in the relationship that the corresponding commitment by agents to the relationship will vary with the ebb and flow of benefits that accrue to them from the relationship.

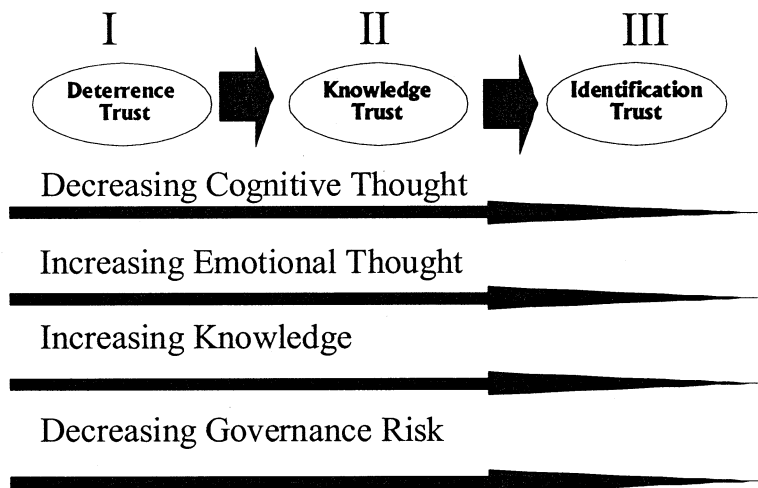


Figure 3. Taxonomy of Trust

Knowledge-based Trust

The second or intermediate level of the Shapiro et al. (1992) taxonomy is knowledge-based trust. As knowledge increases over time, predictability is formed, allowing an individual to react with more certainty in regard to future events. As a result, governance risk, the risk of a failure of the governance structure, decreases (*ceteris paribus*) as an individual moves from deterrence-based trust to knowledge-based trust. Once predictability has been achieved there is a decrease in the importance of the deterrents in the relationship. Through knowledge risk is reduced, though it is not dissolved (Lewis and Weigert, 1985). Thus firms that have a history of working together have experience with strategic alliances or, where public information is ample, would be able to establish a higher form of trusting relationship, one based on knowledge. This, like deterrence-based trust, is a cognitive form of trust.

Identification-based Trust

This form of trust is based more on emotions than either deterrence-based trust or knowledge-based trust. Identification-based trust is the ability of an individual to internalize another's preferences (Shapiro et al., 1992). Identification-based trust is the highest level of trust attainable. In order to access this level of trust, the partners must achieve a level of knowledge where predictability is highly accurate, thus greatly reducing the amount of risk involved. This is achieved through a shared culture or experience set such that your partner's loss is your loss. The most pure form of this type of trust occurs in family governance

structures, whereby a manager and his or her family operate the organization with a consistent, uniform, and unwritten rule set.

Strategic Fuzzy Alliances and the Continuum of Governance

In order to understand the role of trust in governance, it is fundamental to be able to integrate the notion of trust into the continuum of governance. For a strategic fuzzy alliance to exist one must: 1) have a strategic business relationship which is based upon trust; 2) have a noncontract-based agreement; and 3) be in a relationship with at least one other firm.

The Spot Market

In the area of the spot market there are many buyers and sellers. A transaction in this area of the continuum has low asset specificity and low transaction risk, therefore neither contracts nor trust are necessary to complete a transaction. In this region of the governance continuum a thick market condition exists providing ample supply at the right place and time. Thus a strategic fuzzy alliance would not exist in the area of the spot market, because trust *does not* exist in this area.

Vertical Integration

Trust *does* exist at the opposite end of the governance continuum within the vertically integrated firm. One of the efficiency-enhancing characteristics of the vertically integrated firm is the lack of need for contracting to complete each internalized transaction. Noncontract-based agreements are the rule as agents cooperate and coordinate within the firm with little formal governance. This type of trust is usually at minimum knowledge-based, and often with a well-defined corporate culture, is identity-based. However, SFAs are not found at this end of the continuum because only one firm is involved. Strategic fuzzy alliances involve two or more firms.

Hybrid or Quasi-Integration

Throughout the central region of the continuum written contracts of some type, not trust, are the foundation of the governance structure; therefore strategic alliances do not exist here either. In these relationships the contract is a substitute for trust for the purpose of binding the parties to the agreement. Since SFAs are not found in the spot market, hybrid or vertical integration regions of the continuum, an additional dimension needs to be added to the neoinstitutional governance choice continuum (see Figure 4).

On the first plane of the dual continuum, the traditional continuum of governance is displayed. The second continuum offers an additional set of choices for the firm. For each hybrid choice on the neoclassical continuum, there is a matching trust-based choice which may reduce the parties' governance costs.

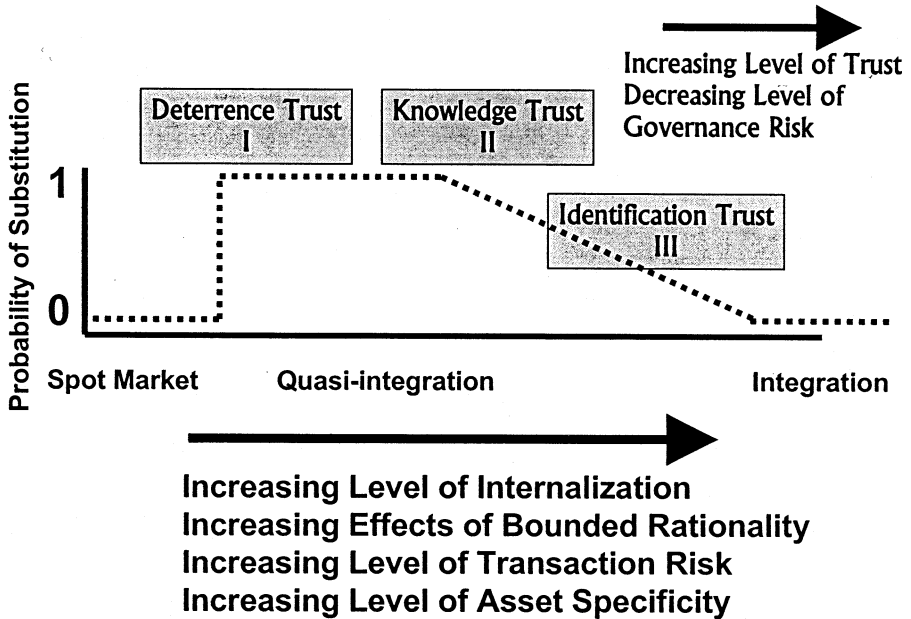


Figure 4. Dual Continuum

Trust-based relationships offer lower friction-related costs but have higher costs related to building relationships and acquiring knowledge. The vertical axis reflects the potential probability, $\{0 \dots 1\}$, of substituting a trust-based structure.

In the spot market the potential for contract-based alliances to be substituted for trust-based alliances is 0, as neither trust nor contracts are necessary for transactions to take place. A higher potential for substitution exists in the area of hybrid structures. However, the further right one moves the probability falls, eventually reaching zero again in the region of vertical integration. This decrease in substitution potential reflects the increasing levels of asset specificity and transaction risk, which may make informal agreements untenable.

There are two distinct governance choice forces at work. Moving from left to right and focusing on the upper continuum, knowledge is increasing and the level of trust needed to bind agents to an agreement is also increasing. The weakest bond is on the left with deterrence-based trust and the strongest bond is on the right with identification-based trust. At the same time that trust is increasing, transaction risk is increasing. Thus, *ceteris paribus*, the more risk that exists the greater the level of knowledge that is necessary. Therefore one can *theoretically* find trust-based relationships that address many types of transactions, even some where risk levels are fairly high. But as transaction risk increases to the highest levels, the power of trust gives way to internalization as the only sustainable

governance choice option. The issue then is for the bilateral partners to generate the level of knowledge or identification to match the risk imbedded in the transaction. This process in itself is a rich area of research, but suffice it is to say that the common process of firms attempting to blend corporate cultures upon forming alliances is an example of the knowledge/identification building process.

In terms of hypotheses concerning firm behavior, trust-based alliances should then be extremely rare at high levels of asset specificity. SFAs should be more common at the left side of the continuum where transactions are relatively simple and risk is low. As risk gets higher, because agents are opportunistic, a high level of knowledge or identification is needed, which is hard to develop. If one believed that agents/firms were becoming more altruistic, in an evolutionary sense, and less economically rational, one would expect to see the probabilities increase and the set of transactions covered by SFAs broaden moving from left to right.

At low levels of asset specificity, deterrence-based alliances (I) are *sufficient* to dominate, while at high levels of asset specificity identification trust-based alliances (III) would be *necessary*. Over the middle range of asset specificity, high levels of knowledge and low levels of identification are needed to replace formal contracts/ownership arrangements. The strategic fuzzy alliance continuum falls moving from left to right reflecting the decreasing likelihood of formation given the increasing transaction risk. On the right-hand side of the continuum, transaction risk is so high that at a minimum, knowledge-based (II) or identification-based trust (III) would be required. Although theoretically unlikely, strategic fuzzy alliances are possible at high levels of risk explaining why the line does not fall to 0 until the area of VI is reached.

EMPIRICAL MODEL

The empirical model will be used to characterize the governance choice decision for firms and to determine some of the important motives of firms involved in alliances. In order for a firm to effectively determine the optimum governance structure it must first assess its own business characteristics in terms of motives and preferences, which are part of the overall characteristics of the transaction. Secondly they must make a choice as to the appropriate governance structure, given the transaction involved. The structures along the dual continuum (Figure 4) represent the choice from which the agent/firm chooses. For any particular firm some structures are more appropriate than others. Empirically, the best statistical model would be one that captures the discrete choice of the decision maker. A multinomial logit model (MNL) is most often used in areas of study where researchers are investigating decision choices of individuals (Ben-Akiva and Lerman, 1985) and when the dependent variable is believed to be discrete, nominal or random (Liao, 1994).

The data used for this study were extracted from a survey³ conducted in 1996 (Dionne et al., 1996). The researchers used a mail survey to contact pork and horticultural processors in Ontario, Quebec and the western provinces about their involvement in strategic alliances.^{4, 5} The total number of observations, 49, was dependent on the number of strategic alliances per company.

The objective of this model is to determine the governance choice, in terms of the type of alliance formed based on firm characteristics. The dependent variables are alliance types and the independent variables are alliance attributes. The dependent variables used in this analysis were: 1) tangible asset-based alliances (TAAs); 2) intangible asset-based alliances (IAAs); and 3) mixed alliances (MAs).

A TAA is an alliance where the partners utilize physical assets that are jointly held. The agreement is held together through the use of a contract or hostage assets and tangible measures of success are used, such as return on investment (ROI). In terms of the Dionne survey, those respondents who defined the motives of their alliance as either: "to share assets, physical resources, or human resources" were coded in the multinomial model to be tangible asset-based alliances.

In an IAA, physical assets are not a feature of the alliance. Instead, it is based on shared assets such as shared knowledge or data. In such fuzzy alliances measures of success are intangible and as such are difficult to calculate. In terms of the Dionne survey, those respondents who defined the motives of their alliance as either: "to penetrate a new market, increase market share, conduct R&D, coordinate marketing, conduct a joint advertising program, or to increase quality," were coded in the multinomial model to be intangible asset-based alliances.

A MA combines characteristics from both TAAs and IAAs giving it a hybrid nature. As a result some aspects of a mixed alliance are measurable and others are not. In terms of the Dionne survey, those respondents who defined the motives of their alliance as either: "to decrease costs or risk" were coded in the multinomial model as mixed asset-based alliances.

The empirical model created for this study is shown below in linear format (Equation 1).

$$\log O_i = \alpha^i + \beta_1^i D + \beta_4^i \text{Trust} + \beta_5^i \text{SP} + \beta_6^i \text{Risk} + \beta_7^i \text{Cost} + \beta_9^i \text{Rate} + \beta_{10}^i \text{Know} \quad (1)$$

The characteristics of the dependent variables $I = \{1, 2, 3\}$

where: 1 = Tangible asset-based alliance (TAA)

2 = Intangible asset-based alliance (IAA)

3 = Mixed alliance (MA)

D = The alliance is either domestic or international.

Trust = The level of trust displayed in the strategic alliance.

Table 1. Hypotheses

<i>Dependent Variables</i>			
	<i>IAA</i>	<i>MA</i>	<i>TAA</i>
H _D	Pos (+)		Neg (-)
H _T	Pos (+)		Neg (-)
H _{SP}	Neg (-)		Pos (+)
H _B	Pos (+)	Pos (+)	Neg (-)
H _C	Ambiguous		Ambiguous
H _{RATE}	Neg (-)		Pos (+)
H _k	Pos (+)		Neg (-)

SP = Satisfaction with the alliance related to increasing sales and profit.

Risk = Satisfaction with the alliance related to decreasing risk.

Cost = Satisfaction with the alliance related to decreasing cost.

Rate = Performance of the firm, after the alliance, as compared with other firms in the same sector.

Know = Knowledge by the processor of the existence of strategic alliances in the same industry.

Hypotheses

From the theoretical model a set of hypotheses have been established reflecting the relationship between firm characteristics and the probability of selecting one of the three governance structures⁶(see Table 1).

The independent variables were:

1. whether or not the alliance was Domestic (**D**). This variable addresses the question of knowledge level between alliance partners, where domestic firms are more likely to share identity than international firms. **Hypothesis 1:** Domestic alliances (**H_D**) would be positively correlated with IAAs (Table 1). This is also supported by Gulati (1995) who found that nonasset-based alliances were likely to be domestic, while asset-based alliances were more likely to be international.
2. the level of trust present in the alliance (**T**). This was a direct question as to the role that trust played in one's satisfaction with the alliance.⁷**Hypothesis 2:** trust (**H_T**) was hypothesized to be positively correlated with IAAs. This was surmised as IAAs do not use contracts to enforce the alliance. Trust was believed to be prominent in this relationship.
- 3-5. whether or not satisfaction with the alliance was related to increasing sales and profit (**SP**), or reducing risk (**R**) and/or costs (**C**). This variable addressed the level and role of calculable and specific measures as critical to the alliance. Fuzzy alliances are by definition based on intangible goals often allowing each member to value the benefits of the alliances individually. **Hypothesis 3-5:** increasing sales and profit (**H_{SP}**), decreasing risk (**H_R**), and

decreasing cost (H_C) are ways in which individuals measure the success of an alliance. **SP** is highly measurable and as such was hypothesized to be positively correlated with TAAs. **R** is an intangible measure of success and thus was surmised to be positively correlated with IAAs or MAs. The hypothesis for **C** was ambiguous because the type of cost being addressed was not specified by Dionne et al., 1996. An SFA reduces both governance and bureaucratic costs; thus it can be hypothesized that this variable should be positively correlated to IAAs. However, because cost is a highly measurable variable it can also be hypothesized that it is positively correlated to TAAs.

6. how the performance of the firm compared to other firms in the same sector (**RATE**). **Hypothesis 6:** rate, (H_{RATE}), was expected to be positively correlated to TAAs, as the attribute is related to measurability and more likely to be used by tangible asset-based alliances.
7. whether strategic alliances were a common strategy in the industry; as measured by the knowledge of the processor of the existence of strategic alliances in the same industry (**Know**). **Hypothesis 7:** the industry standard knowledge (H_K) was predicted to be positively correlated with IAAs. This is because firms with a greater understanding of strategic alliances in their industry, may be more partisan about, and thus more comfortable with, trust-based governance structures than those firms involved in TAAs.

Multinomial Logit Model Results

Goodness of Fit⁸

In this study the empirical model was evaluated using two types of tests, goodness of fit (GOF) and coefficient estimates. The GOF tests, of which four were used, evaluate the overall performance of a chosen model. The four tests used were: 1) predicted outcomes; 2) independence from irrelevant outcomes (IIA); 3) pseudo R^2 ; and 4) chi-square. In terms of predicted outcomes the model had a 71% accuracy rate. In terms of the IIA test the dependent variables were shown to be sufficiently different from each other and do not present a problem for respondents to distinguish between them, thus the model satisfies the IIA condition. The pseudo R^2 for this model was 0.28. Predicting the pseudo R^2 though tends to underestimate the underlying continuous variable (DeMarris, 1992). Finally, a chi-square⁹ test was conducted to test whether or not all coefficients simultaneously equal zero. For this model ($\chi^2 = 22.36$, $df = 13$, $p < 0.05$) the alternate hypothesis, which states that at least one of the predictors has a significant impact on at least one of the logits, is accepted.

Coefficient Estimates

The second evaluative measure of the performance of the model was to analyze the coefficient estimates. Three coefficient estimate tests were used in this study: 1) a global test for predictors, 2) the t -statistic, and 3) the transitivity test.

Table 2. Results of the Multinomial Logit Model

<i>Variable</i>	<i>T vs I¹</i>	<i>M vs I²</i>	<i>M vs T³</i>	<i>Transitivity</i>
Intercept	-0.93 (-0.47)	-2.71 (-1.23)	-1.78 (-0.79)	NA
Domestic	-1.16 (-0.97)	-0.25 (-0.24)	0.91 (0.73)	I > M > T
Trust	-0.40 (-1.37)	0.09 (0.35)	0.49 (1.70)*	M > I > T
Sales/Profit	0.20 (0.17)	-1.05 (-1.14)	-1.25 (-1.12)	T > I > M
Risk	-1.98 (-1.40)	0.27 (0.27)	2.25 (1.66)*	M > I > T
Cost	3.96 (2.90)**	2.34 (2.61)**	-1.63 (-1.17)	T > M > I
Rate	0.79 (1.15)	0.39 (0.68)	-0.39 (-0.62)	T > M > I
Know	-1.86 (-1.59)	1.05 (0.72)	2.91 (1.90)*	M > I > T

Summary of Statistics
 Number of Cases = 49
 L(0) = -51.10
 L(1) = -36.78
 -2 [L(0)-L(1)] = 28.65
 Degrees of Freedom = 13 (Chi-square)
 Pseudo R² = .28
 Percent Correctly Predicted = 71%

Note: 1 & 2 - The dependent variable was ICT (I was the reference category)
 3 - The dependent variable was TCI (T was the reference category)
 The values in parentheses are the t-values for the respective variables
 *significant at the .10 level of confidence
 **significant at the .01 level of confidence

Global Test for Predictors

The global test for predictors¹⁰ was used to determine if any particular predictor has an effect on any of the logits. When the predictors were tested individually, cost was significant at the .05 level; sales/profit, risk and knowledge were significant at the .01 level of significance. Thus, these variables have a significant impact on at least one of the dependent variables. Although trust was not significant at the .10, level it was significant at the .15 level of significance. The other variables used in the model were not significant.

T-test, Coefficient Estimates, and Transitivity Test

A *t*-test was used to determine the significance of the relationship between the independent and dependent variables. The degrees of freedom in this model were 42. In a multinomial logit model; if the sign of the coefficient estimate is negative, the independent variable positively influences the reference category and is negatively correlated to the alternative variable (Liao, 1994; Ben-Akiva, 1985). The transitivity test measures the consistency across independent variables in their affect on the probability of governance choice. The results of the multinomial logit model are shown below (see Table 2).

Domestic (H_D)

Consistent with the hypothesis, though not significant at the .10 level, this variable appears to be positively correlated with intangible asset-based alliances, and negatively correlated with tangible asset-based alliances. The pair-wise comparison met the transitivity test where an intangible was preferred to a tangible, an intangible was preferred to a mixed, and a mixed was preferred to a tangible ($I > M > T$).

Trust (H_T)

Though not significant at the .10 level, trust appears to be positively correlated with intangible asset-based alliances and negatively correlated with tangible asset-based alliances. This was also hypothesized correctly. Mixed alliances appears to be negatively correlated to trust, which is understandable as those involved in these alliances prefer foreign agreements. However, significant at the .10 level, trust is preferred more in a mixed alliance than in a tangible asset-based alliance. The pair-wise comparison met the transitivity test where a mixed was preferred to an intangible, an intangible was preferred to a tangible, and a mixed was preferred to a tangible ($M I T$). For the model comparing T versus I, trust was not found to be significant, however as stated by Ben-Akiva and Lerman (1985), "... the inability to reject the hypothesis that some coefficient is zero at a particular significance level does not imply that the hypothesis must be accepted." This variable, although not significant at the .10 level of confidence, was significant at the .17 level of confidence, and may therefore have some influence on the probability of governance choice.

Sales and Profit (H_{sp})

Though the sign on the estimated coefficient indicates that sales and profit were positively correlated with tangible asset-based alliances and negatively correlated with intangible asset-based alliances, which is consistent with the hypothesis, the estimates were not significant at the .10 level. This is consistent with the model comparing tangible and mixed alliances (M vs. T) where satisfaction due to sales and profit performance was more associated with tangible than the mixed alliances. The pair-wise comparison met the transitivity test where a tangible was preferred to an intangible, an intangible was preferred to a mixed, and a tangible was preferred to a mixed alliance ($T > I > M$).

Risk (H_R)

It was hypothesized that the objective of decreasing risk, because as a goal it was more abstract and unmeasurable, would be positively correlated to IAAs and MAs while being negatively correlated to TAAs. This was accurate as risk was positively correlated with intangible asset-based alliances and negatively corre-

lated with tangible asset-based alliances. When comparing MAs versus TAAs, risk was positively correlated with the mixed alliances and was significantly different from zero at the .10 level of confidence. Comparing TAAs vs IAAs, risk is not significant at the .10 level of confidence, however it is significant at the .17 level of significance. The pair-wise comparison met the transitivity test where a mixed alliance was preferred to an intangible, an intangible was preferred to a tangible, and a mixed was preferred to a tangible alliance ($M > I > T$).

Cost (H_C)

Cost was positively correlated with both tangible asset and mixed asset-based alliances, and negatively correlated with intangible asset-based alliances. The hypothesis for this variable was ambiguous because there was more than one type of cost that the respondent could have taken into consideration. Cost was significant at the .01 level of confidence when TAAs and MAs were compare with IAAs. The pair-wise comparison met the transitivity test where a tangible was preferred to a mixed alliance, a mixed was preferred to an intangible, and a tangible was preferred to an intangible ($T > M > I$).

Rate (H_{Rate})

The question from which this variable was determined asked the respondent to compare their firm with others in the same sector. It was hypothesized that rate would be positively correlated to TAAs and negatively correlated to IAAs, as rate is a measurable variable. Empirically, though insignificant at the .10 level, this appears to be correct as rate was positively correlated with tangible asset-based alliances, and negatively correlated with intangible asset-based alliances. The pair-wise comparison met the transitivity test where a tangible was preferred to a mixed alliance, a mixed was preferred to an intangible, and a tangible was preferred to an intangible ($T > M > I$).

Knowledge (H_K)

Knowledge was used as an industry standard to determine if alliances were so prevalent as to be common. It was hypothesized that firms involved in IAAs were more likely to have information about their sector due to the nature of the alliance. Knowledge was positively correlated with intangible asset-based alliances, and negatively correlated with tangible asset-based alliances. The pair-wise comparison met the transitivity test where a mixed alliance was preferred to an intangible, an intangible was preferred to a tangible, and a mixed was preferred to a tangible alliance ($M > I > T$). This variable was positively correlated to mixed alliances and significant at a .10 level of confidence.

Analysis

Overall the model performed with theoretical consistency, not only satisfying the specified hypotheses but meeting the transitivity tests. The model demonstrates that a discrete choice or managerial decision is in fact being made as to governance choice. From survey summary statistics and the results of the MNLM, it is clear that when firms think about strategic alliances there is a continued reliance on traditional governance and evaluative measures, i.e., increasing sales and profit, reduced costs, and performance comparisons with the rest of the industry. These alliances are not fuzzy, but strategic thrusts requiring standard governance control.

At the same time, as the theory predicted, there is a place for strategic fuzzy alliances. They are knowledge and trust dependent and are distinct from tangible-based alliances. For example:

1. the multinomial logit model showed domestic alliances were more likely to be governed by intangible asset-based alliances (SFAs) than international alliances. Thus, for these alliances, knowledge will be higher, communication easier, and trust greater.

there was a distinct difference with respect to the difficult and idiosyncratic measure of risk reduction, which is consistent with Sporleder's (1992) notion of an alliance with fuzzy rules and governance. In such transaction environments control is weak, the rules are fuzzy and the securing mechanism was most likely a form of trust.

The notion that mixed alliances, those based on motivations that were poorly specified (being both measurable and unmeasurable), should fall in between intangible and tangible alliances was correct on only three of seven variables. Econometrically, it was correct to specify it as a distinct choice, but in effect it was more similar to the intangible alliance than the tangible alliance.

When asked about the success of the firm before and after the alliance, 71% said the firm was doing better than before the alliance.¹¹ They are durable as well; a majority of alliances have been in place 5-plus years. This bodes well for strategic alliances in general, although it may more accurately reflect tangible asset-based alliances. Though respondents were obviously comfortable with the term alliance, clearly their definitions varied across the governance spectrum, some being very similar to tradition business relationships involving some form of a contract, while others involved a high level of trust. But overall, tangible assets and measurability were the rule, not the exception.

When the results of the survey, the discrete choice model and the theory of Figure 4 are brought together it becomes clear managers are solving a tradeoff problem (Williamson, 1975; Goldsmith and Sporleder, 1998). Like the calculus that agents solve between the bureaucracy and the market (Williamson, 1975),

agents, over a relevant range, choose between trust-based and contract -based mechanisms, or some hybrid of the two. This is consistent with Ring and Van de Ven (1992) and Chiles and McMackin (1996) who point out that the relationship between transaction risk, trust, and governance choice is complex and that there could be a simple mapping would be naive.

Where our research differs from Ring and Van de Ven (1992) is with respect to their notion of the relational contract. They state, "because risk is high in these transactions (high asset specificity, high uncertainty, and a high level of recurrence¹²), high levels of trust are not only sufficient; they are also necessary" (p. 492). The above empirics do not bear this out. Those alliances that were tangible-based (higher degrees of asset specificity) had a lower probability of relying on trust. Similarly, those alliances which had lower levels of knowledge, implying greater risk levels, too relied on tangible alliances. True trust-based fuzzy alliances were reserved for lower risk, higher knowledge, lower specificity settings. We would argue that under high transaction risk situations, as described above, firms would choose to integrate rather than attempt to invest in a "... private ordering emerging from ... a 'state of union': an evolving set of safeguards that are mutually agreed to by and for, the immediate parties" Ring and Van de Ven (1992, p. 492). A classic example of this are the causative forces that gave rise to the U.S. dairy cooperative movement that began in the early 1900's and continues today. Faced with high levels of transaction risk in the marketing of their milk, dairy producers, en masse, integrated downstream to the first handler stage of the market rather than attempt to form relational contracts with milk processors. The cost of building a "private set of safeguards that were mutually agreed upon" was and is too high for producers. Instead they opted to internalize the transaction.

Finally, respondent knowledge of the industry in regard to strategic alliances is high, as 76% of respondents said they knew of strategic alliances in the industry, thus implying that strategic alliances are common. As mentioned above there was some statistical evidence from the model that those managers who had greater knowledge (of alliances) were more likely to be associated with IAA or MAA. Tangible-based alliances may evolve into an intangible asset-based alliance, the logic being that by increasing knowledge and trust, a contract can be substituted by trust. This is supported by empirical research done by Gulati (1995). On the other hand, though most respondents were familiar with strategic alliances and had a duration of greater than five years, most alliances were TAA and more likely consisted of a low degree of trust. If the firm is satisfied with the tangible asset-based alliance they may not be motivated to change governance structures. An alliance that is trust-based may seem to have barriers, due to the costs of relationship-building, that traditional business structures do not. The high level of knowledge or trust needed to initiate and pursue an alliance of this type may deter individuals more familiar with the traditional governance structures.

MANAGERIAL IMPLICATIONS

The motivation for this study was to understand the role of trust in governance. Neoinstitutional economics, while being extremely microanalytical with respect to governance, appears to have left out the notion of trust. Much of transaction theory is devoted to the role of contracts and bureaucracies to offset agent opportunism, information impact, and transaction risk, yet empirically, trust-based governance structures exist and can perform quite well. Trust-based alliances reduce costs, increase efficiency, and allow flexibility necessary for success in a rapidly changing market place. Trust-based alliances cannot be directly placed on the Williamson (1975) governance choice continuum of markets, contracts and hierarchies thus making it necessary to create a dual continuum. This manuscript developed an additional continuum of governance with substitute trust-based structures.¹³

Trust-based governance is not a complete substitute for all forms of traditional governance though. At low levels of specificity and transaction risk, neither trust nor contracts are necessary to complete a transaction. At the highest levels of specificity, trust is critical to the transaction, but risk is so high as to require integration. In the middle or hybrid area where many transactions occur; traditionally governed through contacting, of one form or another, one finds trust-based agreements as well. The potential for trust to substitute for a contract and the ability for trust to offset transaction risk is a function of knowledge and predictability. Thus, theoretically, one would predict that fuzzy alliances are more likely to be found governing transactions of low specificity and transaction risk. Agents may not be willing to make the investment in knowledge and identity building. Though the above survey was not a random sample, it does characterize the alliances of the study firms where tangible-based alliances and their measurable performance dominated. This empirical result and its supporting theory stands at odds with the comment made by Axelrod (in Hill, 1990): individuals that stress cooperation and trust rather than opportunism dominate the population of players.

Integrating Shapiro's taxonomy of trust into a neoinstitutional model of governance choice, a move from low to high forms of knowledge and predictability can offset greater and greater amounts of transaction risk. The lowest levels of trust, based on deterrence, does not require greater altruism on the part of bilateral trading partners as they are based strictly on economic rationality and idiosyncratic measurement of costs and benefits. This is useful as it reconciles any apparent contradiction between trust-based governance and neoinstitutional theories of opportunism.

For managers the theory and empirical test put forth in this manuscript helps remove some of the mysticism being attached to alliances and their use of trust. Trust can be an important transaction governance mechanism but there are severe

limits on its ability to control risk, particularly the investment needed in relationship building. Das and Teng (1998) state:

to trust and to control seem to be two completely different kinds of approaches. When it is fully possible to trust a partner, there is no need to control its behavior. Control comes into play only when adequate trust is not present (p. 495).

Traditional mechanisms for attenuating transaction risk such as contracts and joint ventures still dominate the governance space. As this manuscript and the lengthy literature on trust conveys, trust is an investment in a relationship; depending on the transaction environment and agent characteristics, an investment which may or may not be worth making.

For managers looking to engage in a trust-based relationship, the form of the relationship will, in part, be a function of the risk characteristics of the mutual transaction. Trust can be very cost effective and efficient for regulating transactions, but there are severe limits to trust's enforcement powers. By increasing knowledge and familiarity between the transaction partners, trust and its power can be enhanced. This "investment" in a relationship can generate excellent returns in terms of lower monitoring costs and better performance. The manager's problem as to governance choice is a tradeoff problem. While trust and investment in trust can be beneficial, there is a risk that the relationship will fail. While the expectation for corporate life may be infinite, the expectations for alliance life may need to be less than infinite. This can be due to the dynamics of the marketplace creating alternative opportunities for a transaction partner or it could be due to opportunistic behavior by the partner. It is the stochastic nature of this disruption that exposes managers to governance risk.

Given this, the manager must decide whether the risk in the relationship is worth taking. The manager must look at the downside risk of the relationship as well the upside opportunities. A fundamental component of answering the tradeoff problem is how valuable a set of assets can the manager place at risk? These assets may be physical assets such as a linked production facility, intellectual property such as firm specific knowledge, or intangible assets such as a brand. The risk to underlying assets is especially acute in the economic environment of the food industry where the landscape can change so dramatically. Thus if risk is high, control is paramount for a manager. Trust-based arrangements are limited in their ability to control. There are though examples of high risk, yet trust-based governance mechanisms. For example, family-owned and operated organizations, utilizing the highest form of trust, identity trust, can rely on an informal set of rules even though asset risk is high (a comparative advantage of nepotism). For the average firm though, to achieve this degree of knowledge and familiarity is difficult and rare. Trust-based relationships should be used where underlying asset risk is low, exit and entry speed are paramount, flexibility is important, and exit costs are minimal. As the relationship evolves and more

experiences are common, the relationship is able to support more risk. Alternatively, hybridization can occur where formal arrangements are made for broad goals and objectives, and day-to-day decisions are left to trust.¹⁴

Success of a trust-based alliance is rooted in knowledge and a proper matching of the limits of the relationship to each firm's expectations. Knowledge and familiarity are important lubricants to keeping a relationship moving forward. Transaction partners represent different histories, cultures and norms. By building knowledge through interaction and common experiences, suspicions and unwarranted fears are displaced. Thus an investment in relationship maintenance programming, such as regular communication, joint meetings, or common leisure activities can aid partners build trust. Certainly choosing a partner with a compatible set of norms is advantageous for maintaining a successful relationship. Since trust is a function of familiarity, the more one partner can identify with the other, the greater will be the understanding and the more easily suspicions will be displaced. Finally, a successful relationship can be helped by having realistic expectations of the informal arrangement. In light of this, partners should *ex ante*, unilaterally as well as bilaterally, clarify their expectations and examine successful as well as failed relationship scenarios. This would help partners avoid governance misalignment (the wrong governance structure for the transaction) by identifying the transaction risk characteristics, their own level of comfort with their partner, and their expectations as to outcomes.

The crux of the issue which this paper addresses is: what is the role of trust in governance? It reduces to a question of the impact of opportunism on the transaction interface and the ability for agents to depart from strict economic rationality and engage in relationship building. It is clear that knowledge and identification enhance trust, but is it, *ceteris paribus*, sufficient to offset moderate to high levels of transaction risk?

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NOTES

1. Previously, firms chose partners not conducting business in the same competitive space as themselves but, more often than not, in the same industry. Therefore a level of familiarity existed between them allowing contracts to be designed using a common experience set, thus, reducing the transaction risk of the agreement. More recently, however, firms have been aligning themselves with partners with whom they are less familiar such as: competitors, suppliers, distributors and non-competing firms (Troy, 1994; Bamford and Jamieson, 1989). For example: 1) Domino's Pizza uses networks set-up by Coca-Cola when entering new markets in

other countries (Bamford, 1994), and 2) To save on cost, Pillsbury ships products on the same trucks as their competitors and then actively competes against them in the marketplace (Andel, 1996). Under these new arrangements a firm's knowledge base is less applicable, as past experience in their own industry may not be helpful when working with firms in another sector. Strategic contract alliances, formed within the same competitive space, have a higher level of risk than previous arrangements formed with non-competitors.

2. A universal definition for strategic alliances does not exist. They have been described as agreements between two or more firms, in the same sector, banding together to achieve a common goal (Vyas, Shelburn and Rogers, 1995; Troy, 1994; Reger, 1993). To help enforce the relationship, hostage assets and contracts can be used (Westgren, 1994; Borys and Jemison, 1989).
3. For an overview of this survey see Adams (1998).
4. The overall return rate was 33%.

Statistical Overview of Survey Data

The results of the frequency analysis showed that 73% of the respondents questioned were involved in domestic alliances and 26% were involved in foreign alliances. 82% of the alliances were described as involved in vertical moves, while 6% involved horizontal moves. In 39% of the cases, the governance choice of the firm was a short-term contract, less than 5 years; 24% chose a joint venture; and 21% chose a long-term contract. Of the cases studied, 94% of the alliances still existed and 76% of respondents were satisfied with the results of the alliance. 27% of the respondents selected a high level of trust, 33% a mid level of trust, and 14% a low level of trust when describing characteristics integral to their satisfaction of the alliance. When asked what performance criteria best illustrated the respondents' satisfaction, 63% said sales and profit had increased, 24% felt that risk had been reduced and 43% said that costs had been decreased. Rating the performance of the firm after the alliance, as compared with before the alliance, 71% felt performance had improved, 16% found that there had been no change and 10% discovered that performance had decreased. When compared with other companies in the same sector after the alliance, 79% thought the firm's performance levels had improved, 10% felt there had been no improvement and 6% found performance had decreased. When asked about their knowledge of alliances in their sector, 76% had previous knowledge of alliances in their industry, and 14% did not.

6. Mixed alliances do not appear in all the hypotheses because they are assumed to lie between the other two alliances, as it has been defined as a hybrid of tangible and intangible-based alliances. Specific theory related to these types of alliances does not exist.
7. In the original survey respondents were asked as to "...describe the motives that seem to be responsible for your degree of satisfaction." Their choices were trust, respect and competence. They could mark only one or all three. We re-coded the answers into a five point Likert scale (below) to

be used as the independent variable, Trust. A response of trust alone would signify the purest motivation in terms of the independent variable, while competence, signaling a strong element of measurability, substitutes for trust in supporting the alliance.

	<i>Types of Trust</i>		
	<i>Trust</i>	<i>Respect</i>	<i>Competence</i>
0-High	X		
1	X	X	
2	X	X	X
3		X	X
4	X		X
5-Low			X

8. When a multinomial logit model is utilized, one of the dependent variables is dropped and it becomes the reference category; this is the element against which the other dependent variables are compared. For this study there were three dependent variables: tangible asset-based alliances (TAA), intangible asset-based alliances (IAA), and mixed alliances (MA). The first variable in each run of the model was the reference category, i.e., IMT, $I = 0$, the reference category, $M = 1$, and $T = 2$. The three models run were: 1) MTI, 2) TMI, and 3) IMT.

1. *GOF Test #1: Predicted Outcomes*

The model was used to predict the governance choice decision {0, 1, or 2}. This prediction was then compared to the actual choice. The higher the percentage of correct predictions, the better the goodness of fit. In this case 21 out of 28 cases were accurately predicted to be an IAA, 8 out of 12 cases were correctly determined to be an MA and 6 out of 10 cases were rightly predicted to be a TAA. By dividing the total of these correct predictions 35, by the total number of cases, 49, the percentage accurately predicted was found to be 71%.

2. *GOF Test #2: Independence from Irrelevant Outcomes (IIA)*

The test for IIA is a test for irrelevant alternatives and one of the most critical for multinomial logit models. It tests whether the decision-maker truly has a choice set, as specified in the model. In the case of the above model, it tests for the discreteness of the governance choices. This test was conducted by dropping one of the dependent variables at a time, running a reduced model, and then comparing the signs, values, and the significance of the coefficient estimates to those of the full model. Of the potential 21 sign changes (7×3), there were 4 sign changes all related to variables (Sales and Profit, Domestic, and Rate) which had insignificant coefficient estimates in the full model and insignificant estimates in the reduced models. Estimated coefficient values and significance levels were little changed. Overall the reduced models predicted the same results as the full model, so one can

conclude that the dependent variables are *sufficiently* different from each other, and do not present a problem for respondents to distinguish between them. The model satisfies the IIA condition.

GOF Test #3: Pseudo R²

The pseudo R² determines how related the predictors are to the dependent variables. This test uses the log likelihood values of the full (L1) and reduced models (L0). The pseudo R² for this model was 0.28. However, it should be noted that this method of predicting the pseudo R² tends to underestimate the underlying continuous variable (DeMarris, 1992).

GOF Test #4: Chi-square

A chi-square tests whether or not all coefficients simultaneously equal zero. For this study the log likelihood function for the full model, L1, was 36.78. The log likelihood function if all the coefficients, except the intercept, are 0; L0, was 51.10. The chi-square value is determined by subtracting L1 from L0. For this model ($\chi^2 = 22.36$, $df = 13$, $p < 0.05$) the alternate hypothesis, which states that at least one of the predictors has a significant impact on at least one of the logits, is accepted.

9. $\text{Chi-square} = -2\log(L0/L1) = (-2\log L0) - (-2\log L1) = -2(\log L - \log L1)$
10. A global predictor test is used to determine if a particular predictor (X_1) has an effect on any of the logits being tested. The test is performed by running the full model and then running a reduced model, which excludes the predictor the researcher wishes to test. The chi-square value from the restricted model is then subtracted from the chi-square value for the full-model, the degrees of freedom are $M-1$, where M equals the number of dependent variables. The null hypothesis is that X_1 has no effect on any of the $M-1$ logits. The alternate then, is that X_1 has an effect on at least one of the logits. If the test is significant then H_0 is rejected and the researcher can assume that the predictor being tested has an effect on at least one of the logits.
11. See note 5.
12. See Goldsmith and Sporleder (1998) and their discussion of "frequency."
13. It is certainly possible, and probably the norm to think that the governance choice decision may involve a combination of trust and contracting and that it is not simply a binary choice.
14. This is commonly done with employment contracts. While the risk is too high to rarely permit a fully trust-based arrangement, the larger issues such as wages and benefits are specified while the day-to-day conduct is left to the employees' discretion.

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